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EXERCISE INTERVENTIONS TO IMPROVE POSTURAL DEFORMITIES

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ABSTRACT

This paper aims to answer the research question: 'How can neck and back exercises prove effective as a treatment for spinal deformities like postural kyphosis, and be implemented as preventative measures for high-risk groups such as adolescents?' Studies by González-Gálvez et al., and Elpeze & Usgu (2022) revealed exercise interventions as an effective treatment for individuals with established postural kyphosis. The findings of this research paper confirm that exercise interventions can also be an effective preventative measure for correcting muscle strength imbalances earlier in adolescents. However, factors such as exercise consistency, carrying backpacks, and habitual postures pose a significant challenge to the benefits of exercise interventions. Solutions include backpack-wearing technique correction, physical activity dispersion throughout the day, and self-discipline improvement. It was found that by incorporating these strategies along with strengthening exercises into the daily lives of adolescents, the risk and severity of postural kyphosis and other spinal deformities in the future will be reduced.

KEYWORDS: Postural Kyphosis, Adolescents, Muscle Strengthening, Exercise Intervention

INTRODUCTION

The iconic diagram of human evolution depicts the progressive straightening of human posture, from quadrupedal species to *Homo sapiens*. However, recently, there seems to be an ironic increase in the reversion to a hunched stance, reminiscent of ancestors, due to postural kyphosis. Commonly known as 'round back' or 'hunchback', kyphosis refers to the excessive curvature of the spine and exists in three forms: Postural, Scheuermann's, and Congenital, with Postural being the most common. It occurs when the ligaments and muscles that hold the vertebrae (spinal bones) in place are stretched by slouching or poor posture. This stretching pulls the vertebrae from its standard position and gives the spine its rounded appearance ("Kyphosis: Symptoms, types, treatments," n.d.).

In modern times, experts have observed an increase in the prevalence of musculoskeletal system problems particularly within adolescent populations. Cross-sectional survey comparisons from 1991 to 2001 show an increase in reported weekly back pain between 23% to 50% for boys and 44% to 50% among girls (Hakala et al., as cited in Torsheim et al., 2010). Parallel to this, adolescents are spending an increasing amount of time on screen-based activities (Nelson et al., as cited in Torsheim et al., 2010), which could indicate the existence of a causal relationship between the two. Thus, this research paper aims to determine the best back and neck exercises that can be implemented to prevent the progression of postural kyphosis in adolescents.

Thesis Statement: The increase in the prevalence of postural kyphosis illuminates the role of exercise in people's lives, demonstrating the potential to not only halt the progression of spinal deformities but also correct and maintain spinal alignment in the adolescent demographic.

METHODOLOGY

This research paper employed a qualitative, secondary research methodology to investigate the topic of postural kyphosis and the effectiveness of exercise interventions in preventing and correcting it among adolescents. The choice of this methodology was justified by the need to synthesize and analyze existing research findings and insights from various sources, including academic studies, surveys, and expert opinions. This approach allowed for a comprehensive review of the available literature and the extraction of relevant data and evidence to support the research objectives. Additionally, a qualitative approach was chosen as it enabled a deeper exploration of the relationships between exercise, posture, and musculoskeletal health in the adolescent demographic.

LITERATURE REVIEW

The last two decades have seen an exponential increase in technology usage across all ages. While it has touched everyone, the demographic most affected - and possibly at the greatest risk - are youths, from babies to adolescents. As technology has become integrated into their life at an increasingly younger age, poor posture becomes reinforced for longer periods. Consequently, this raises concerns about their vulnerability to spinal deformities in the future. Research conducted by Straker et al. (2007) investigated the relationship between computer usage and habitual spinal postures in 884 adolescents (408 females and 476 males). Participants completed a questionnaire about their weekly computer usage, which was measured in hours, and were then assessed on their habitual spinal posture through photographic analysis while sitting and standing. Their findings revealed that increased computer use was correlated

with specific postural changes: in males, an increase in head and neck flexion whereas in females, an increase in lumbar lordosis. Given these problematic changes, it becomes crucial to find ways to prevent or correct them. Researchers González-Gálvez et al. (2019) experimented to analyze the specific effect of different exercise programs on the kyphosis and lordosis angles in 284 cases and 255 controls. Five electronic databases (PubMed, Cochrane, WOS, PEDro, and EBSCO) were searched up to 31 July 2018. Study quality was performed by PEDro score, external validity was assessed using the EVAT and the risk of bias was assessed using the SIGN 50 checklist for randomized controlled trials. Their results demonstrated a large significant effect of the exercise on thoracic kyphosis (SMD = -1.400, p = 0.000) but a moderate but not significant improvement (SMD = -0.530, p = 0.401) in the lumbar lordosis angle. These findings were supported by Elpeze and Usgu (2022), whose study investigated the effect of a comprehensive corrective exercise program (CCEP) on the kyphosis angle and balance in kyphotic adolescents. Using a sample of 62 male adolescents (ages 10-18, mean BMI 21.7 kg/m^2) with a thoracic kyphosis angle of ≥ 50°, participants were divided into three groups using simple randomization: CCEP, TEP, and control. Exercise interventions lasted for 40-50 minutes, three times a week for 12 weeks. The results revealed both the CCEP and TEP resulted in a significant reduction in the kyphosis angle ($p < 0.001$), with CCEP having a more profound effect than TEP ($p < 0.020$). Only the CCEP group showed improvement in postural perception ($p < 0.001$) and balance within the group ($p < 0.001$). However, when comparing balance changes between the groups, there was no significant difference ($p > 0.05$). Fortunately, there are easier and more accessible alternatives that individuals can implement in their daily routines. Verywell Fit provides a simple guide titled "Great Upper Back Exercises to Improve Your Posture," which focuses on strengthening the upper back – a crucial area for maintaining good posture. Cervical posture must also be considered for optimal spinal health. A common cervical deviation is the Forward Head Posture, which often coexists with postural Kyphosis. The American Sport and Fitness Association (ASFA) sheds light on the often-neglected sternocleidomastoid muscles, with their article, "Strengthen Your Sternocleidomastoid Muscles with These Exercises.", which plays a key role in cervical posture. These guides offer a set of exercises that can be performed without requiring extensive equipment or training.

Analysis of Exercises

The exercises that will be evaluated will target muscles in the chest, back, and neck. For chest and back, this includes Barbell High Rows, Reverse Fly, Upright Rows, Renegade Rows, Dumbbell Snatch, and Seated Rows. To specifically target the Sternocleidomastoid muscle in the neck, exercises such as Neck Flexion, Neck Extension, Lateral Neck Flexion, Neck Rotation, and Isometric Neck exercises are included.

Barbell High Rows

This exercise trains the muscles in the middle and upper back (latissimus dorsi, rhomboids, trapezius, posterior deltoids) along with the biceps. It can also be performed with a dumbbell if a barbell is not available (Frey, 2021).

Reverse Fly

The upper back muscles (especially the rhomboids and trapezius) and the rear deltoids (back of the shoulder) are targeted in this movement. The neck should be kept long and the chin tucked for this exercise. Should hunching should also be avoided.

Upright Row

The upright row works the front and middle heads of the deltoids. It also builds the trapezius, rhomboids, and even the biceps (Rogers, 2022).

Renegade Rows

It is performed in a plank position, so muscles in the core also work in addition to the upper back muscles. The muscles specifically targeted are the upper back (latissimus dorsi, rhomboids), shoulders (deltoids), triceps, abdominals, quadriceps, forearms, and spinal erectors (Williams, 2020).

Dumbbell Snatch

The Dumbbell snatch is a dynamic movement that works various muscles to promote the uplifting motion. This includes the deltoids, triceps, gluteus maximus, erector spinae, hamstrings, latissimus dorsi, trapezius, and muscles around the scapula (Dewar, 2023).

Seated-Rows

A compound exercise that trains the middle back as well as the arms. Muscles targeted in this movement include the latissimus dorsi, rhomboids, trapezius, biceps, and triceps. Other stabilizing muscles are the hamstrings and gluteus maximus.

Neck Flexion

Sit or stand upright with shoulders relaxed. Slowly tuck the chin towards the chest, feeling a stretch in the back of the neck. Hold this position for a moment, then slowly lift the head back to the starting position. Repeat 10-15 times.

Neck Extension

Sit or stand upright with shoulders relaxed. Slowly tilt the head back, looking up toward the ceiling, feeling a stretch in the front of the neck. Hold this position for a moment, then slowly return the head to the starting position. Repeat 10-15 times.

Lateral Neck Flexion

Sit or stand upright with shoulders relaxed. Slowly tilt the head to one side, bringing the ear towards the shoulder, feeling a stretch in the opposite side of the neck. Hold this position for a moment, then slowly return the head to the starting position. Repeat 10-15 times for each side.

Neck rotation

Sit or stand upright with shoulders relaxed. Slowly turn the head to one side, looking over the shoulder, feeling a stretch in the opposite side of the neck. Hold this position for a moment, then slowly return the head to the starting position. Repeat 10-15 times for each side.

Isometric Neck Exercises

Sit or stand upright with shoulders relaxed. Place one hand on the forehead and gently press the head into the hand, resisting the movement with the neck muscles. Hold for 5-10 seconds, then relax. Repeat on the back and sides of the head 3-5 times, resisting the movement in each direction.

DISCUSSION

Research done by González-Gálvez et al. (2019) showed that exercise programs focused on muscle strengthening had a significant positive effect on reducing thoracic kyphosis angle. Supporting this, Elpeze and Usgu (2022) discovered that Comprehensive Corrective Exercise Programs (CCEP) exhibited the most significant decrease in participant kyphosis angle, as well as improved postural perception and balance. Therefore, from these findings, it can be logically assumed that postural exercise interventions will be effective at reducing the development and severity of postural kyphosis. This is because an improvement in back muscle strength can correct postural imbalances earlier, potentially mitigating the severity of postural kyphosis in the future by maintaining skeletal alignment. While all included exercises target the muscles responsible for posture, it would be more efficient and effective to only implement the 'best' to maintain engagement. This includes Renegade Rows, Dumbbell Snatch, and Seated Rows, and excludes Barbell High Row, Reverse Fly, and Upright rows as they train fewer muscles in comparison. All sternocleidomastoid muscle exercises should be completed as studies have shown that in sample sizes ranging from 56 to 127 participants, 51.78% to 63.69% of them have forward head posture ("Forward Head Posture in Young Adults: A Systematic Review," 2022). These exercises involve isotonic concentric and eccentric contractions, which will lead to muscle hypertrophy but also Delayed Onset Muscle Soreness (DOMS), which is usually felt after a day or two following eccentric exercises. Therefore, an appropriate workout routine that comprises adequate recovery time and workout goals will need to be developed. The number of sets and repetitions for each compound exercise depends on the purpose of the training as seen in Figure 1 below.

	Reps	Sets	Rest
Strength	≤6	2 to 6	2 to 5 minutes
Hypertrophy	6 to 12	2 to 6	30 to 90 seconds
Endurance	≥12	2 to 3	≤30 seconds
Power	1 to 5	3 to 5	2 to 5 minutes

Source: Winderl (2022)

Figure 1: Training parameters for different purposes of training

Since postural deformities are caused by muscle strength imbalances, the main focus when completing the exercises becomes strength. Furthermore, the World Health Organisation (WHO) recommends an average of 60 minutes per day of moderate-to-vigorous intensity physical activity across the week as well as a reduction in the amount of time spent sedentary, particularly the amount of recreational screen time (World Health Organization, 2022)

Counter Arguments

While the effects of the exercise routine seem promising, there are some potential problems. One of them is the consistency of the exercise routine, which relies on self-discipline. According to Psychology Today, self-discipline can be improved in a multitude of ways. But with the adolescent demographic in mind, time blocking and understanding the purpose seems to be an effective solution. Time blocking refers to the allocation of time, long or short, to a specific task. Adolescents can distribute the recommended 60 minutes of physical activity throughout the day to make it more manageable. Understanding the purpose of this routine could be another way to improve discipline as it increases the likelihood of consistency by providing intrinsic motivation (Tracey, 2021).

Another potential problem could be the influence of external and internal factors, such as carrying backpacks, and habitual standing, and sitting posture, that may offset the progress of adolescents. This can be addressed in several ways. For backpacks, schools could teach students how to wear a backpack correctly, so the weight is distributed more evenly, eliminating any slouching. The ideal weight for a backpack should be 10 percent of a child's body weight and should never exceed 20 percent (The Backpack World, 2023). Alternatively, adolescents could invest in rolling backpacks to reduce the strain placed on their backs, thereby allowing them to focus better on their posture. For habitual standing and sitting posture, it is advised to take micro-steps towards the goal as breaking a habit is an unfamiliar process (Calechman, 2022). Adolescents can do this by puffing out their chest and moving their head back and fixing it in place from time to time. These steps should be repeated each time they become aware that their posture is inadequate, gradually establishing healthier habits.

CONCLUSION

Previous research done by scientists and health experts has revealed that exercise interventions are effective at addressing postural kyphosis. Exercises, particularly those that strengthen weaker muscles to correct muscle strength imbalances, can play a crucial role in posture correction at an earlier stage, reducing both the risk and severity of spinal deviations in the future. Back exercises such as Renegade Rows, Dumbbell Snatch, and Seated Rows, have been determined to be more efficient and effective as they target a larger range of muscle groups while using affordable equipment such as resistance bands and dumbbells. Neck exercises specifically targeting the sternocleidomastoid muscle have also been considered as cervical posture is essential for spinal health. Therefore, it is clear that physical interventions must be integrated into adolescent lives to improve spinal health, reducing the risk of developing and severity of postural kyphosis and other deformities in the future.

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